

Effects of Household Products Disrupting Pheromone Communication on Local Species of Ants in Bryan-College Station

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Abstract: The purpose of this experiment was to study the attraction habits of *S. invicta* to common household products in College Station, Texas. *S. invicta* is a nuisance to the agricultural industry as they cause damage to equipment and lower crop yields. Various common household products ranging from dental hygiene to food products were used in the study. Products that exhibited the most attractive properties included foods with high sugar content. Among the household products with the lowest attractive properties were acidic substances such as tapatio hot sauce, listerine, and 40% ethanol spirit (vodka). Basic substances such as hand soap also exhibited poor attractive properties.

Keywords: Solenopsis invicta, Household products, Pheromone, Ant communication

Introduction

The imported fire ant (*Solenopsis invicta*) in Texas is largely considered a pest that disrupts urban and agricultural areas (Cokendolpher and Phillips 1989). Since the early 1930's, *S. invicta* has continually spread across east, south, and central Texas--especially affecting the Bryan-College Station area (Pimm and Bartel 1980). Coupled with painful bites, their widespread expansion, and aggression, *S. invicta* pose a threat to the health of many communities in Texas, especially to vulnerable groups like young children and the elderly (Lennon). *S. invicta* can also be perilous to healthy individuals if a multiple stinging incident occurs, an individual could possibly go into

anaphylactic shock. In part, *S. invicta* are not the only known pest ant species

Ant species use hormonal signals known as pheromones to organize colonies and their behavior. Pheromones play an important role in the social behavior of ants which works similarly as an analog communication system. If one ant wants to communicate information to another, pheromones are produced which are then processed as a signal for a variety of behaviors. Examples of behaviors include: queen/worker interaction, worker/worker interaction, alarm pheromones linked to aggression (Vander Meer et al. 1998). Importantly, for this experiment, ants will typically follow the trail with a higher concentration (Thienen et al. 2014). The objective of this experiment is to

observe the possible additive and disruptive effects of household products on ant pheromone detection and communication.

Materials & Methods

The capture method is modeled after two previous experiments: one examining the effect of urbanization on ant abundance, the other is a student publication investigating native and invasive ant communities in College Station (Buczowski and Richmond 2012; Caprio et al. 2017). This model was chosen to allow a larger variety of specimens necessary for comparison and remain non-disruptive to the environment. It is important that the collected specimens are foragers, which will likely exhibit the worker/worker behavior this experiment will observe (AntWiki 2019a).

This experiment will be conducted in an urban dwelling and be tested at West Campus near the Texas A&M Clocktower. Three baits will be used: honey, sausage bits, and bacon. Food items will be placed separately on index cards and placed uniformly at the selected locations near ant mounds. Thirty minutes will be given anytime during the day to capture the ants alive and whole. The collections will take place at mid morning or late afternoon when it is cool outside preferably between 15–43°C as this is when the ants forage (Porter and Tschinkel 1987). Some specimens will be frozen or preserved as soon as possible after collection for identification. Living specimens will be transported using a chamber or insect carrier for testing in a lab. The collection cycle will

last all throughout October with specimen collection once a week.

Using various kinds of household products, such as Blueberry Chex cereal, Nature Valley oats and honey bar, Hi-Chew, Crest toothpaste, milk and golden honey Softsoap, Round Rock honey, Grey Goose Vodka, antiseptic Listerine original, Tapatio salsa picante hot sauce, and tea tree oil, the ants' behavior will be tested and observed. Communication will be the main focus, which includes trail and alarm pheromones (Resh et al. 2009). The behavior of individual ants and the interaction between the ants will be watched and recorded. Behavior towards the household products will be recorded as attracted, repulsed, or neutral depending on how the ants react. Ants which follow a household product for at least 3 seconds will be said to display attraction while those which actively avoid a household product display repulsion. Ants that display neutral behavior neither follow nor avoid a household product. After each product was tested, it was removed and cleared of any trace so that it would not interfere with testing and results of the following household product.

Results

The specimens were identified by the following characteristic using the Texas A&M Agrilife Extension Texas Pest Ant Identification: An Illustrated Key to Common Pest Ants and Fire Ants. The identifying characteristics include: two nodes (petiole and post-petiole) with sting present, eyes large with base of antenna covered,

gaster not hung below post-petiole, 10 segment antenna with 2 segment club at end and red and black body, compound eyes.

Based on these characteristics, all the ants collected were identified as *Solenopsis invicta* (hymenoptera:formicidae), the imported fire ant. While comparing different ants from the same collections, it was observed that there were drastic size differentiations between many of the ants. This is due to the fire ant's caste system as their worker caste is either monomorphic or polymorphic with series of intergrades between major and minor workers (fig. 1).

The urban locations of collection were at Texas A&M Clocktower and Lot 74.

The possible preferential attraction of common household goods to *S. invicta*, the

control, blueberry chex cereal, attracted 46 specimens. The Mango Hi-Chew taffy piece lathered in milk and golden honey Softsoap attracted only 1 specimen. The Nature Valley Honey and Oats bar attracted 21 specimens. The Blueberry Chex cereal covered in tea tree oil attracted only 1 specimen. A teaspoon of Round Rock honey attracted only 33 specimens. The Blueberry Chex cereal covered in antiseptic Listerine original attracted only 1 specimen. The Blueberry Chex cereal covered in Colgate toothpaste attracted no specimens. The Blueberry Chex cereal covered in Tapatio salsa picante hot sauce attracted only 1 specimen. The Blueberry Chex cereal covered in Grey Goose Vodka attracted only 1 specimen.

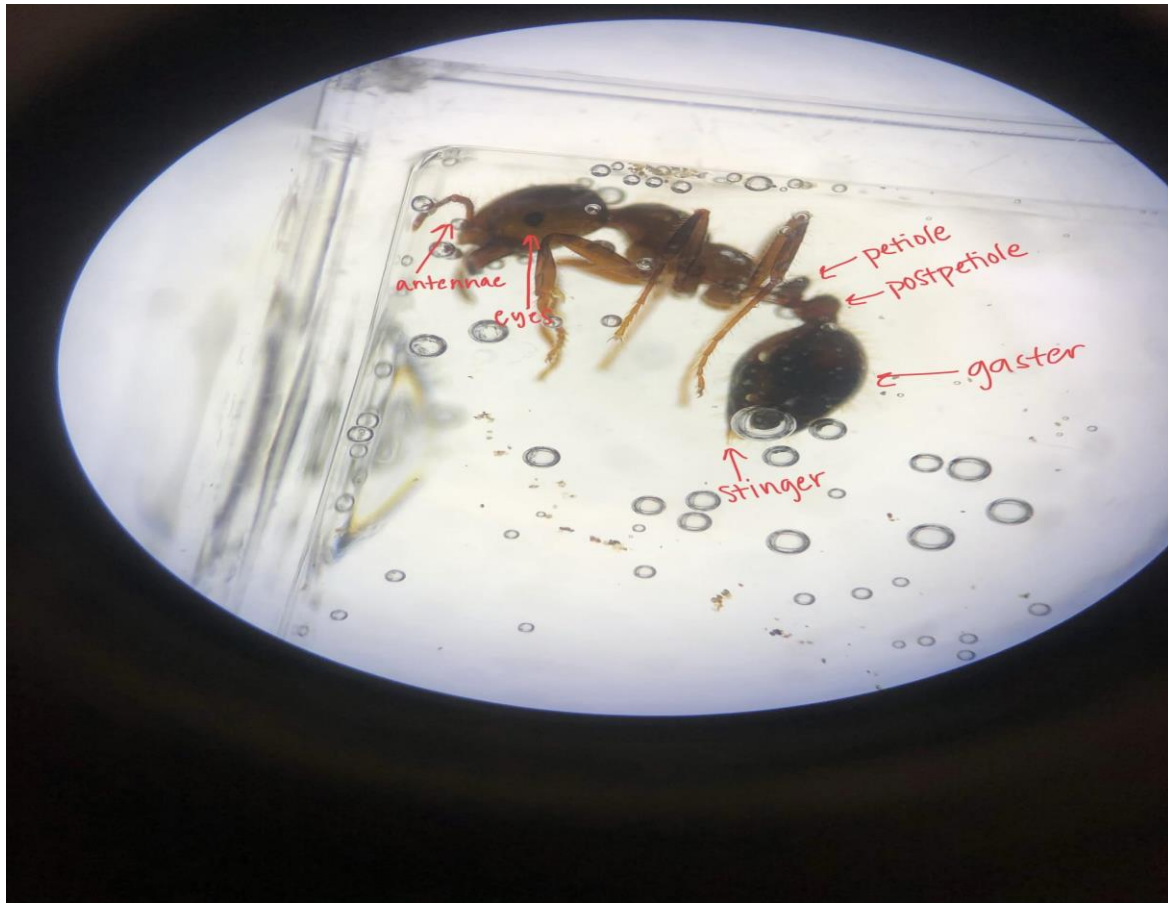


Fig. 1. Lateral view of *Solenopsis invicta* as shown.

Discussion

The objective of this experiment is to observe the possible additive and disruptive effects of household products on ant pheromone detection and communication. For the initial trial, the Blueberry Chex cereal was chosen as the control and was expected to attract a high number of specimens. The cereal is an ideal additive control due to its high carbohydrate content. This is not to say the most attractive items were all of the chex cereal items, as the cereals covered in various common items had varied results. For starters, it was expected that the other uncovered food items would yield similar or better results than the control. This was

indeed what had occurred with the Nature Valley Honey and Oats bar and Round Rock honey. On the other hand, the other products, Listerine, Colgate toothpaste, Tapatio hot sauce, Grey Goose vodka, and milk and golden honey Softsoap were expected to have disruptive effects on communication.

It is interesting to note that the covered chex cereal pieces with Listerine, Colgate toothpaste, Tapatio hot sauce, and Grey Goose vodka did not attract many specimens. The Hi-Chew taffy covered in milk and golden honey Softsoap also did not attract many specimens. Despite the fact that the chex cereal piece and taffy would provide nutrients for the colony, the household

products mentioned had an adverse effect on the foragers' response.

It was expected that the Colgate toothpaste would attract more specimens than observed because of the presence of the ingredient sorbitol, an alcohol sugar. It cannot be concluded that the specimens were attracted to sorbitol, however, from the observations from the trial the toothpaste attracted no specimens. It is possible that an active ingredient or the effects of menthol have a disruptive effect on *S. invicta*.

For Listerine, Tapatio hot sauce, and Grey Goose vodka there were no expectations of attractive large amounts of specimens. Upon observation during the trial forager specimen had approached but disregarded each product with what could be described as complete disinterest. A strong commonality between these products is the low pH range. It is possible that high acidity products may interfere with communication between specimens or the specimen may have adapted--as a species--to avoid acidic compounds. Additional tests with products with a wide range of pH would allow further investigation. However, based on the

observations made it can be confirmed that Listerine, Tapatio, hot sauce, and Grey Goose vodka have a disruptive effect on *S. invicta* communication.

Expectations for the milk and golden honey Softsoap were different than the previous products. It was postulated that the Softsoap would have two possible outcomes: one, the fragrant quality of the soap would attract some number of specimens; two, the slippery, basic, composition of the soap would deter the specimens. Upon observation, only one specimen was attracted to the soap lathered taffy. Similar to the other disruptive products, the high pH, or high basicity, of Softsoap may be considered unattractive and not a viable source of nutrition.

Conclusively, the Blueberry Chex cereal, Nature Valley Honey and Oats bar, and Round Rock honey were certainly additive products that attract *S. invicta*. Listerine, Colgate toothpaste, Tapatio hot sauce, Grey Goose vodka, and milk and golden honey Softsoap all did not or hardly attracted any specimens. Thus these products are considered disruptive in attracting *S. invicta*.

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Materials Needed:

- 1 Pack of Blank White Index Cards (100 ct., 3"x5")
- 10 Wet Cat Food Cans
- 3, 12oz containers of wildflower Honey
- 1, 32oz container of Soybean Oil
- 3, 8oz Glass Jars
- 10 Plastic Testing Trays
- 1, 64oz Heinz Distilled White Vinegar
- 1, 5lb Bag of Sugar
- 1, 26oz Canister of Epson Salt
- 3, Fresh Lemons
- 3, Sharpie Marker Pens
- 1, 2.37oz Bottle of McCormick Ground Cinnamon
- 1, 65oz Box of 20 Mule Team Borax